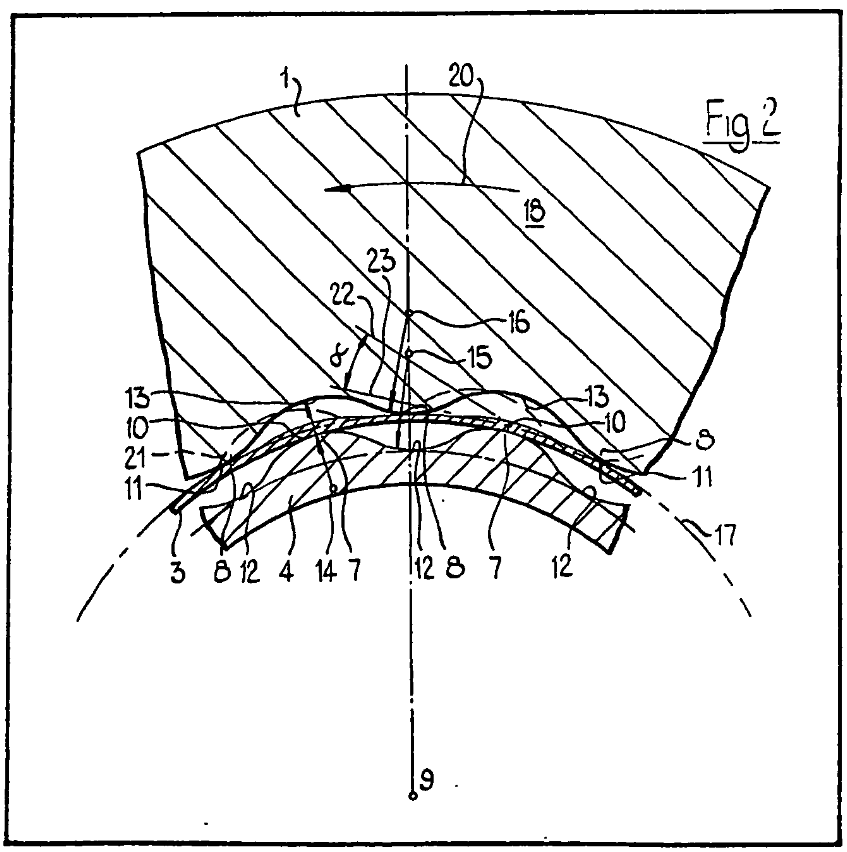
(12) UK Patent Application (19) GB (11) 2 015 122 A

(21) Application No 7904507
(22) Date of filing 8 Feb 1979
(23) Claims filed 8 Feb 1979
(30) Priority data
(31) 2807485
(32) 22 Feb 1978
(33) Fed. Rep. of Germany (DE)
(43) Application published
5 Sep 1979
(51) INT CL[2]
F16D 65/12
(52) Domestic classification
F2U 224 260 276 280
288 296 310 314 318 390
F2E 2N1A4A1 2N1C1
2N1C3 EK
(56) Documents cited
GB 1536893
GB 1432458
GB 1350350
GB 1238630
GB 1163219
GB 1085322
GB 275881
GB 266259
GB 263103
(58) Field of search
F2E
F2U
(71) Applicant
Alfred Teves GmbH., 7
Guerickestrasse, 6000
Frankfurt Am Main,
Germany
(72) Inventor
Hans-Henning Luepertz
(74) Agent
M. C. Dennis

(54) Mounting Brake Discs

(57) A brake disc 1 for a motor vehicle is mounted on a hub 4 of a wheel of the vehicle which is to be braked with provision for axial displacement and limited rotational movement with respect thereto. The confronting surfaces of the disc (1) and hub 4 are provided with matching projections 8, 7 and are separated by a space in which a resilient band 3 is arranged. The band 3 is tensioned by the projections 8, 7 of the disc and hub bearing on opposite faces thereof. Upon rotational movement of the brake disc with respect to the hub during a braking action the tensioning of the band 3 is increased.



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

GB 2 015 122 A

2015122

1/1

Fig.2

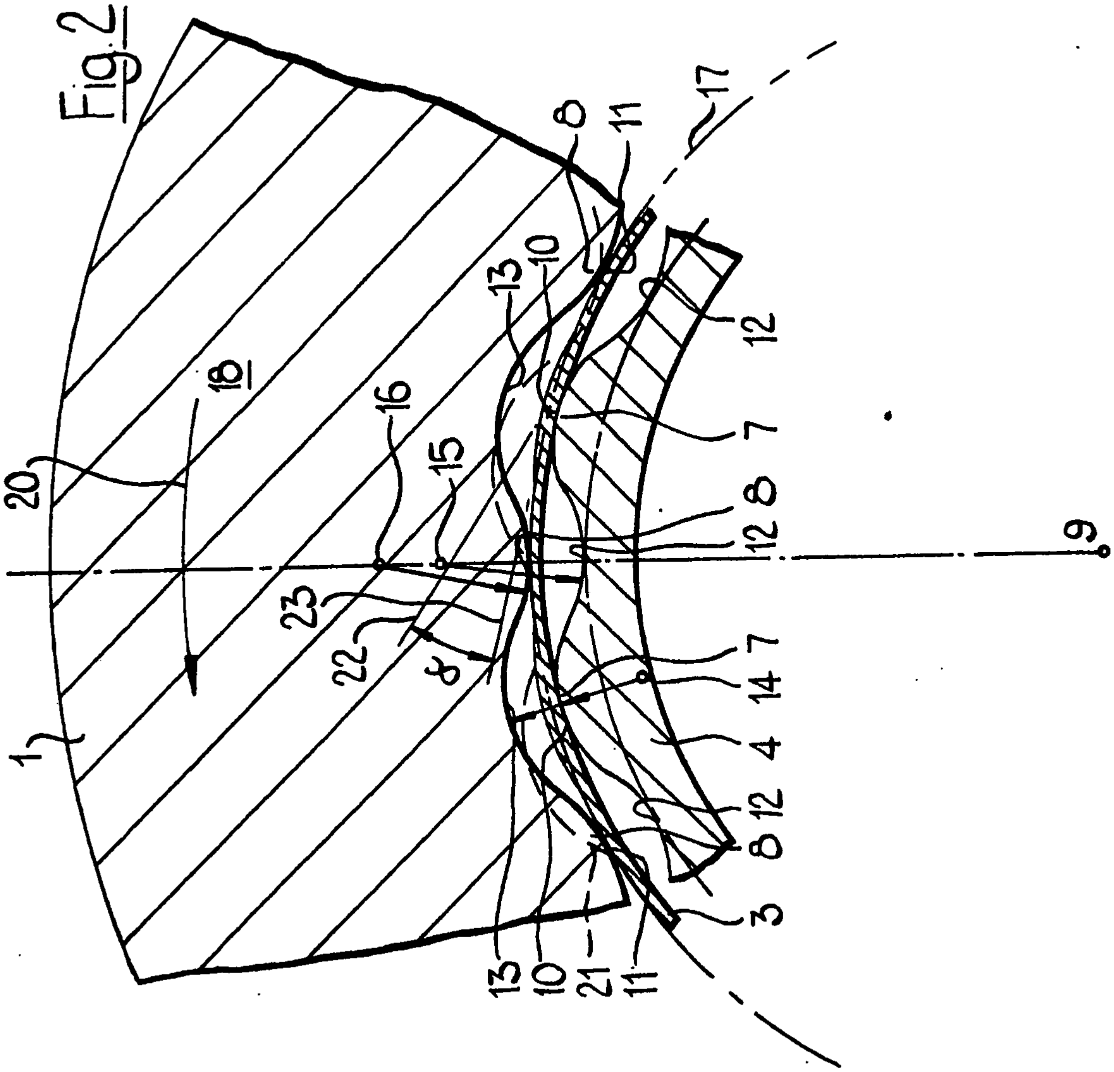
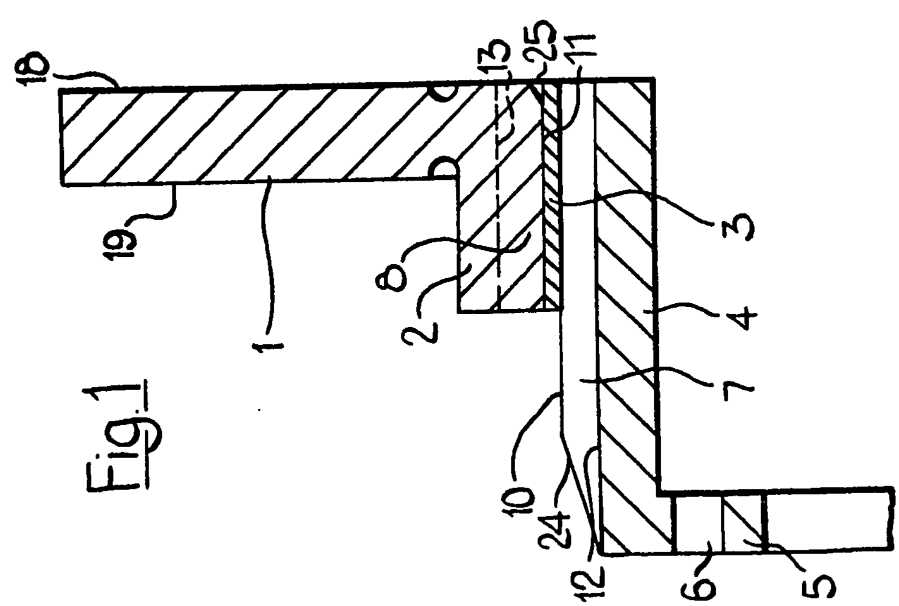


Fig.1



SPECIFICATION
Disc Brake

The present invention relates to a brake disc and hub combination, in particular for a motor vehicle employing a disc brake to brake rotation of the hub, the brake disc being axially displaceable on the hub.

Axially displaceable brake disc are employed in disc brakes which have a sole actuation device arranged on one side of the brake disc and which actuation-device, by means of a friction lining, will press the brake disc against an undisplaceably arranged friction pad. In such brake discs, there exist special requirements with regard to the connection between the brake disc and the hub. This connection has to ensure an easy axial displaceability of the brake disc, on the one hand, yet serve for the transmission of high torque forces, on the other hand.

In a known disc brake (German Utility Model (Dt-GM) No. 7,012,103) which has an axially displaceable brake disc, the brake disc has radially extending projections which project into recesses of the hub and come into mesh with radially aligned guide surfaces of the hub. Further, leaf springs are provided opposite the hub for centring of the brake disc, said springs being connected at the hub and acting on outside surfaces of the projections which are cylindrical in respect of the axis of rotation of the brake disc.

Said known design of a brake disc is disadvantageous in that already in case of small torques there will be an engagement of the torque transmission surfaces at the projections and the hub, thus any axial displacement of the brake disc in respect of the hub being possible only against the frictional drag caused by the transmitted torque. Due to the influence of dirt, said frictional drag may develop such proportions that the axial displaceability of the brake disc will be impaired considerably and that the brake shoes arranged on either side of the brake disc will be exposed to uneven wear.

According to the present invention, there is provided the combination of a brake disc and a hub for a motor vehicle, which brake disc is mounted on the hub with provision for axial displacement and limited rotational movement with respect thereto, wherein confronting surfaces of the brake disc and the hub are separated by a space and are each provided with a plurality of projections extending transversally to the disc, wherein a resilient band is arranged in the space and tensioned by the projections bearing on opposite faces thereof, and wherein upon rotational movement of the brake disc with respect to the hub during a braking action the tensioning of the band is increased.

An embodiment of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a radial section taken through a portion of a brake disc and hub employing the present invention, and

Figure 2 is a sectional side view of the brake disc and hub of Figure 1.

Brake disc 1, as shown in Figure 1, has a substantially cylindrical foot 2 which rests on a resilient band 3. The band 3 is arranged on a hub 4 that may be mounted to a rotary component, such as, for example, the wheel hub of a vehicle, by means of an annular flange 5 and bores such as 6. The hub 4 and the brake disc 1 have confronting projections 7, 8 provided at their adjacent faces with part-cylindrical (in cross-section) surfaces 10, 11 that are aligned in parallel with the axis of rotation 9. The number and the spacing of the projections 7, 8 of the hub 4 and of the brake disc 1 are the same. Between the projections, there are part-cylindrical surfaces 12, 13 of opposite curvature (recesses). In the position shown in Figure 2, the surfaces 10 and the surfaces 13 have common centre lines such as 14. The centre of curvature of the central surface 12 is designated by the reference numeral 15, that of the central surface 11 is designated by the reference numeral 16.

The relative arrangement of the projections 7 and 8 is such as to ensure that the maximum distance between a surface 10 and the axis of rotation 9 equals the minimum distance between a surface 11 and the axis of rotation 9. Reference numeral 17 indicates a circular arc described around the axis of rotation 9 which will barely touch the surfaces 10 and 11.

The resilient band 3 arranged in the space between the hub 4 and the brake disc 1 lies on the surfaces 10 of the hub 4 and on the surfaces 11 of the brake disc 1. Since the thickness of the band 3 exceeds the radial distance between the surfaces 10, 11 with respect to the axis of rotation 9, its shape deviates from that of the circular arc 17. Due to preloading (tensioning) of the resilient band 3, a radially aligned normal force is present at the contact surfaces 10, 11, said normal force ensuring a centring of the brake disc with respect to the hub and bringing about a frictional engagement by means of which the brake disc is carried by the hub in the direction of rotation thereof.

Upon a braking action, at first, one brake shoe (not shown) is pressed against friction surface 18 of the brake disc 1. Due to the frictional engagement, a torque force is generated in correspondence with the vector 20 illustrated in Figure 2 and will at first be transmitted by frictional engagement from the brake disc 1 to the hub 4 via the band 3. The torque force 20 increasing due to the increase of the braking pressure, the frictional engagement between the brake disc 1 and the band 3 or even between the band 3 and the hub 4 will be overcome whereupon a relative movement of the brake disc 1 will ensue with respect to the band on the hub 4. As the torque force 20 will be generated by a contact force acting on the friction surface 18 in a direction parallel to the axis of rotation, the relative movement of the brake disc 1 is not only subject to the

action of the torque force 20 but also to that of the contact force directed in the axial direction, consequently the brake disc shifts in the circumferential and in the axial directions. The displacement in the axial direction will cause the friction surface 19 of the brake disc 1 to come into engagement with a further brake shoe (not shown) which is undisplaceable. As the loading of the resilient band 3 increases, a further increase of the torque force will finally bring about the position of the brake disc 1 in respect of the hub 4 illustrated by the broken line 21. In this position, there will result a positive engagement between the projections 7 and 8 via the band 3, said positive engagement being suitable for the transmission of high torque forces.

Line 22 indicates a tangent at the centre of the contact surface between a projection 8 and the band 3 in the position of the brake disc 1 illustrated by the broken line 21. The line 23, which indicates the direction of the movement of the centre of the contact surface at a projection 8, is a tangent with respect to a circular arc around the axis of rotation 9. Together, the lines 22 and 23 define an angle alpha (α). If this angle exceeds the frictional angle rho (ρ) of the two engaging frictional materials, the band 3 and the projections 8, the loading force of the band 3 will suffice to turn the brake disc 1 back in a direction opposed to the vector 20 after the release of the brake, as a result of which the above described process may be repeated upon a new actuation of the brake.

In order to facilitate the assembly of the brake disc and of the hub the latter has a chamfer 24 of less than 45 degrees, the brake disc having a chamfer 25. The assembly is performed in such a way that at first the resilient band 3 is slipped on to the projections 7 of the hub 4 via the chamfer 24. Subsequently, the brake disc 1 is slipped from the left-hand side on to the resilient band 3 whereby a preloading (tensioning) will be brought about in the band, said preloading being necessary in order to achieve the required frictional engagement.

The inventive design of the disc brake will ensure that, upon the onset of a braking action, the resilient band, in frictional engagement, will transmit the torque force, which at first is small, from the brake disc to the hub. The torque force increasing, there will be a relative movement between the brake disc and respectively the resilient band and the hub in the circumferential direction, said relative movement resulting in a more pronounced deformation of the resilient band and thus in an increase of the normal forces which are acting on the frictional engagement between the brake disc and the hub until, in the extreme case, there will be a positive engagement. The relative movement serves to overcome the frictional forces between the brake disc and the hub. Consequently, small forces which are acting on the brake disc in the axial direction will be sufficient in order to bring about an axial deflection of the relative movement of the brake disc. The hub will cease to transmit any further guiding forces to the brake disc in the axial direction as soon as the frictional engagement between the brake disc and the hub has been overcome.

Therefore, when in frictional engagement, the brake disc will still be able to move axially, even in the event of high frictional forces, in order to be capable of yielding to the compressibility and to the wear of the brake lining as well as to the expansion of the brake caliper. A special advantage of the inventive disc brake further consists in that the relative movements ensuing upon any braking action will entail a self-cleaning effect thanks to which any corrosion and dirt particles will be removed. Further, the disc brake is temperature-stable as it will not need any temperature-sensitive materials and as the frictional engagement between the hub and the brake disc is characterised by great radial elasticity. If the brake disc is worn out it may be easily replaced. The brake disc can be pulled off the hub without the hub having to be screwed off the wheel.

In an advantageous embodiment the end faces of the part-cylindrical projections of the brake disc and of the hub are arranged at approximately the same distance with regard to the axis of rotation of the brake disc. Positive engagement is possible only by means of the resilient band fixed between the brake disc and the hub. The advantage of this primarily consists in small deformation of the resilient band and in using its flexural strength for achieving the required frictional engagement.

When using a resilient band of small flexural strength, it will be advantageous if the radial distance between the surfaces of the part-cylindrical projections of the hub and the disc is less than the thickness of the resilient band.

The end faces of the projections will preferably be part-cylindrical. This design will ensure that the notch effect on the resilient band will be small. It will be especially advantageous if the "inner" ends of the projections are connected by means of part-cylindrical interfaces of opposite curvature. In this way, it will be possible to keep the notch effect that will act on the hub and the brake disc small. Further, an easy manufacture by means of, for example, broaching will be possible.

The resilient band is preferably made of soft steel. The maximum deformation and length of the resilient band are advantageously co-ordinated such as to ensure that the strain will remain below the yield point of the material.

It will be particularly advantageous if the number of the projections on the brake disc and the hub is odd since this will counteract the formation of vibrations caused by friction during a braking action, such vibrations tending to bring about symmetrical deformations.

In respect of the design of the projections it will further be advantageous if confronting surfaces and interfaces each have a common centre line. From this design smaller radii of curvature will ensue for the surfaces of the projections which

will be promotive of a return movement of the brake disc into an initial position after the release of the brake. In order to axially carry along the resilient band together with the brake disc, the resilient band may be positively connected to the brake disc at one or more points, or the brake disc may have a shoulder at its rear end (left hand in Figure 1), said shoulder projecting beyond the projections and serving as stop for the resilient band.

The normal forces achieved by the preloading of the resilient band between the band and respectively the hub and the brake disc, are, as a rule, sufficient in order to bring about a reliable centring of the brake disc with respect to the hub. In some applications, however, an additional centring may be desired. To this end, the hub or the brake disc may be arranged so that, by means of suitable dimensioning of the surfaces which are part-cylindrical with respect to the axis of rotation of the brake disc, the brake disc lies on three or more projections of the hub, or vice versa.

Claims

1. The combination of a brake disc and a hub for a motor vehicle, which brake disc is mounted on the hub with provision for axial displacement and limited rotational movement with respect thereto, wherein confronting surfaces of the brake disc and the hub are separated by a space and are each provided with a plurality of projections extending transversally to the disc, wherein a resilient band is arranged in the space and tensioned by the projections bearing on opposite faces thereof, and therein upon rotational movement of the brake disc with respect to the hub during a braking action the tensioning of the band is increased.

2. The combination as claimed in claim 1, wherein the radial distance between the projections of the brake disc and the hub is less than the thickness of the resilient band.

3. The combination as claimed in claim 1 or 2, wherein the projections are part-cylindrical.

4. The combination as claimed in claim 3, wherein part-cylindrical projections are separated by part-cylindrical grooves of opposite curvature to the projections.

5. The combination as claimed in any one of the preceding claims wherein the resilient band is made of soft steel.

6. The combination as claimed in any one of the preceding claims wherein the maximum deformation and length of the resilient band are co-ordinated such that the strain on the band will remain below the yield point of the material comprising the band for all possible positions of the brake disc relative to the hub.

7. The combination as claimed in any one of the preceding claims, wherein both the brake disc and the hub have an odd number of projections.

8. The combination as claimed in any one of the preceding claims, wherein prior to a braking action the projections of the brake disc, or hub, have respective common centre lines with grooves positioned between the hub projections, or brake disc projections, respectively.

9. The combination as claimed in any one of the preceding claims, wherein the resilient band is positively connected to the brake disc at one or more points.

10. The combination as claimed in claim 9, wherein the brake disc is provided with a shoulder on its rear side, as seen in the direction of axial displacement occurring upon a brake actuation, which shoulder extends further towards the hub axis than the brake disc projections and serves as a stop for the resilient band.

11. The combination as claimed in any one of the preceding claims wherein to facilitate assembly the brake disc projections and grooves therebetween at their front side, as seen in the direction of axial displacement occurring upon a brake actuation, and/or the hub projections and grooves therebetween on the rear side, are chamfered at an angle less than 45 degrees.

12. The combination of a brake disc and a hub substantially as herein described with reference to and as illustrated in the accompanying drawings.

13. A disc brake having a combination as claimed in any preceding claim.

14. A brake disc, hub and resilient band as claimed in any one of the preceding claims when made or sold separately.

15. A motor vehicle braking system including a disc brake as claimed in claim 13.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1979. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.